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Reply to: 3430 Evaluation

Date: October 10, 1980

Subject: Hat Creek, Grays Valley Dwarf Mistletoe Evaluation

To: Forest Supervisor, Lassen NF

On September 8 - 11, 1980 John Kliejunas, Dennis Hart and Will Hoskins from the FIDM Staff conducted a biological evaluation of insect and disease problems at two locations on the Lassen National Forest. The first location was the Hat Creek area on the Hat Creek Ranger District, and the second was the Grays Valley area on the Eagle Lake Ranger District. The specific objective of the evaluation was to determine the suitability of the areas for use as dwarf mistletoe control demonstration plots.

OBSERVATIONS

HAT CREEK AREA

The area examined included Sec. 35 (T32N, R4E), consisting of approximately 1/4 section of a 17-year-old ponderosa pine plantation with an overstory of Jeffrey pine in some spots, approximately 1/2 section of mixed conifer type (Jeffrey pine, white fir), and approximately 1/4 section of islands of pure Jeffrey pine intermixed with the mixed conifer type, and Forest Service-owned land in Sections 26 and 34. Site index is moderate to high. Salvage logging of trees in the islands of pure Jeffrey pine killed by the Jeffrey pine beetle, Dendroctonus jeffreyi, was done in 1979.

Two disease problems are prevalent in the plantation. Most residual overstory Jeffrey pine are infected with western dwarf mistletoe, Arceuthobium campylopodum. These infected residual trees are providing sources of infection for the planted pines and will continue to cause new infections as long as they are present in the plantation. Dwarf mistletoe infections in the planted trees thus occur in discrete areas where infected overstory trees were left, and are absent from areas of the plantation where no overstory source of infection is present. Many of the understory trees are already heavily infected, with Hawksworth dwarf mistletoe ratings of 5 and 6. A rating of 5 or 6 indicates severe infection, in which the trees are generally growing at a slow rate and the probability of death is high. Elytroderma disease, caused by Elytroderma deformans, was also common; crown infection ranged from light (less than 1/3 of the crown infected) to heavy (2/3 or more of the crown infected).

The islands of pure Jeffrey pine were heavily infected with dwarf mistletoe. Most infected trees had ratings of 5 and 6 and many trees were distorted as a result of bole infections, swellings, and brooming of infected branches. Elytroderma disease was common. Mixed conifer stands

were extremely overstocked, with basal areas averaging 420 sq. ft./acre. Jeffrey pines in the mixed conifer stands were lightly to heavily infected with dwarf mistletoe. Elytroderma disease was present.

Most white fir trees observed had no insect or disease problems, except for two trees with stem cankers. The cause of the fir canker is unknown; both insects and fungi are associated with the lesions. Since the cankers result in stem breakage in recently thinned stands, cankered firs should be removed and not selected for leave trees when stands are thinned.

Annosus root disease, caused by Fomes annosus, was not specifically observed during this evaluation, but the disease is known to be present, and common, in the area.

GRAYS VALLEY AREA

The area examined included the southeast portion of Sec. 8 and the west one-half of Sec. 20, T33N, R8E. The area contains stands of young, approximately 80-year-old, sawtimber, of east-side Jeffrey pine, ponderosa pine, and mixed conifers (Jeffrey pine, ponderosa pine, white fir). The area was selectively logged in the 1940's. Site is medium, portions of the stands are overstocked, and the area is subject to drought conditions during late summer months.

No problems on white fir were noted. The pines were lightly to heavily infected with western dwarf mistletoe. Root disease centers caused by Fomes annosus were common. Attacks by the Jeffrey pine beetle, mountain pine beetle (Dendroctonus ponderosae) and the western pine beetle (Dendroctonus brevicomis) were common on pines weakened by dwarf mistletoe and/or annosus root disease.

BIOLOGY OF PEST ORGANISMS

WESTERN DWARF MISTLETOE

The dwarf mistletoes are parasitic seed plants that attack only conifers. Western dwarf mistletoe (Arceuthobium campylopodum) infects Jeffrey, ponderosa, knobcone, and Coulter pines. The dwarf mistletoes are obligate parasites which are completely dependent on their host for support, for water, and for most of their mineral and organic nutrients. They often cause the formation of "witches brooms", or dense masses of distorted branches, on the host which divert nutrients from the rest of the tree. Infection of trees by dwarf mistletoe results in reduction of growth, growth abnormalities, mortality, and predisposition to other pests.

Dwarf mistletoes spread between trees and within crowns of trees by means of small seeds that are forcibly ejected into the air. Spread from overstory to understory is limited to the distance traveled by the seeds, usually 20-60 feet, but it can be as much as 100 feet if assisted by wind. Dwarf mistletoe spreads upward in infected trees at a rate of about 4-6 inches/year.

ELYTRODERMA DISEASE

Elytroderma disease is caused by Elytrodema deformans, a fungus which infects mainly Jeffrey and ponderosa pines. It has also been reported on knobcone, lodgepole, and pinyon pines. The disease is spread by spores which are dispersed from small fruiting bodies produced on infected needles. After the spores infect current year's needles, the fungus becomes systemic in twigs. This perennial twig infection serves to reinfect each year's needles as they grow out and causes them to die and drop off the second year. Infected twigs retain only the current year's needles. The systemic infections also produce "witches brooms" similar in appearance to witches brooms produced by dwarf mistletoes. The disease may cause significant growth loss when more than 40% of the crown is infected. Although direct killing of mature trees is infrequent, moderate to severe infection predisposes the tree to other diseases and to bark beetle attack. The impact of the disease can be reduced by removing trees with more than 40% of the crown infected and by favoring resistant species.

ANNOSUS ROOT DISEASE

Fomes annosus is a root rotting fungus that attacks a wide range of woody plants, causing a decay of wood and death of sapwood and cambium. All western conifer species are susceptible to the fungus. Hardwood species are rarely damaged or killed.

During favorable periods, the fungus forms fruiting bodies in decayed stumps, under the bark of dead trees, or in the duff at the root collar. The fungus becomes established in freshly cut stumps from air-borne spores produced by the conks, and then grows into the root system. The fungus subsequently spreads to healthy roots of surrounding susceptible tree species via root contacts. Local spread of the fungus outward from a stump typically results in the formation of disease centers, with dead trees in the center and fading trees on the margin. These centers usually continue to enlarge until they reach barriers such as openings or groups of non-susceptible plants.

The fungus may remain alive in infected roots and stumps for as long as 50 years in east-side pine. Young susceptible tree species often become infected and die after their roots contact old infected root systems in the soil.

Once annosus root disease is established in a stand, no direct procedure is available for controlling it. Control, therefore, involves prevention of new centers by decreasing the risk of stump infection. Application of granular borax to freshly cut stumps is effective in preventing most (90%) new infections. The chemical is toxic to the spores of F. annosus but has no effect on existing infections. Borax application requires the submission of a Pesticide Use Request.

JEFFREY PINE BEETLE

The Jeffrey pine beetle attacks only Jeffrey pine. There is one generation per year with adults attacking trees from late March through October. Only the bole of the tree is attacked, and it will not breed in the branches or slash. The Jeffrey pine beetle normally attacks scattered individual trees which are predisposed by overmaturity, root disease or heavy infections of dwarf mistletoe or Elytroderma disease. This beetle has an aggregating pheromone which serves to attract other Jeffrey pine beetles into the area of a tree under attack. Once the beetles are near the initial tree under attack, they may be able to overcome other, healthy trees by their sheer numbers. In years of adequate precipitation, mortality due to the Jeffrey pine beetle usually occurs as single trees or several trees growing close to each other. When precipitation is below normal, the Jeffrey pine beetle can kill larger groups of trees, including some apparently healthy trees.

WESTERN AND MOUNTAIN PINE BEETLES

The western and mountain pine beetles breed in ponderosa pines which are stressed or are in a state of low vigor because they are overmature, or weakened by predisposing factors such as root diseases, dwarf mistletoe or overstocking. Like the Jeffrey pine beetle, these beetles have an aggregating pheromone which increase the chance of group killing. Thinning of overstocked stands should help reduce bark beetle-caused mortality by increasing the vigor of residual trees, making them more likely to be able to resist attacks.

MANAGEMENT OPTIONS

Several actions are available that may be taken separately or in combination to reduce the impact of western dwarf mistletoe on the areas evaluated. The options are not mutually exclusive, and there are situations where a combination of the options would apply.

1. No change in present management. Levels of dwarf mistletoe will increase in intensity in those pine trees already infected, debilitate and kill those trees in the severe category, and continue to spread to surrounding susceptible trees. The present level of stand overstocking will continue to reduce tree vigor and make them more susceptible to bark beetle attack, especially during periods of drought.

2. Reduce impact of dwarf mistletoe. Several alternatives for reducing the impact of dwarf mistletoe in the course of normal stand operations are available.

   a. Overstory removal. Removal of infected overstory residuals in the plantation will eliminate a source of infection for surrounding understory trees. The remaining understory can then be thinned and/or pruned to eliminate dwarf mistletoe

infections. All freshly-cut stumps should be treated with borax to prevent invasion by Fomes annosus.

b. Sanitation thinning. The objectives are to remove the heaviest infected trees and to reduce basal area to stimulate growth. Thinning of infected stands will maintain optimum growth of the residuals and reduce stress. Mistletoe-infected trees should be selected against. The removal of all trees with Hawksworth dwarf mistletoe ratings of 5 and 6 should be considered because these trees will likely die during the next 10-year period, most likely during the next drought. If height growth of pines is increased by 12"/year following thinning, they may outgrow the dwarf mistletoe.

   Trees heavily infected with Elytroderma disease should be selected against when possible. All freshly-cut stumps should be treated with borax. The increase in growth and reduction of stress of trees remaining after thinning will make them less susceptible to bark beetle attack.

c. Clearcut and regenerate. Some islands of pure Jeffrey pine are already so heavily infected that individual trees are dying and others are suffering significant growth losses. These areas will continue to be unproductive and clearcutting followed by regeneration would be the best way to utilize the site. Mistletoe-resistant firs can be regenerated, or, if pines are regenerated, they should be protected from dwarf mistletoe infection from surrounding trees by creating a buffer zone to reduce the chances of infection moving back into the regeneration. Natural barriers such as roads, meadows, species changes or uninfected stands should be used as borders wherever possible.

d. Species selection. Because dwarf mistletoes are host specific, the western dwarf mistletoe infecting Jeffrey and ponderosa pines will not infect white fir. In mixed conifer stands white fir could be favored over pine during thinning operations. This would reduce or eliminate the impact of dwarf mistletoe on the site, and also reduce the impact of Elytroderma disease.

FIDM funds are available that can be used to establish dwarf mistletoe control demonstration areas. The objective of demonstration areas is to gain acceptance of control techniques or strategies through the use of on-the-ground display. These areas would serve for training and demonstration, as well as provide information for determining the biological and economic impact of dwarf mistletoes on Forest productivity. If the Lassen Forest is interested in use of the Hat Creek and Grays Valley areas as demonstration areas, our FIDM Staff will develop a work plan and establish the areas in cooperation with the Districts involved.

If there are any questions concerning this biological evaluation or if additional information is desired, contact John Kliejunas (415) 556-6864 or Dennis Hart (415) 556-6940 of the FIDM Staff.

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